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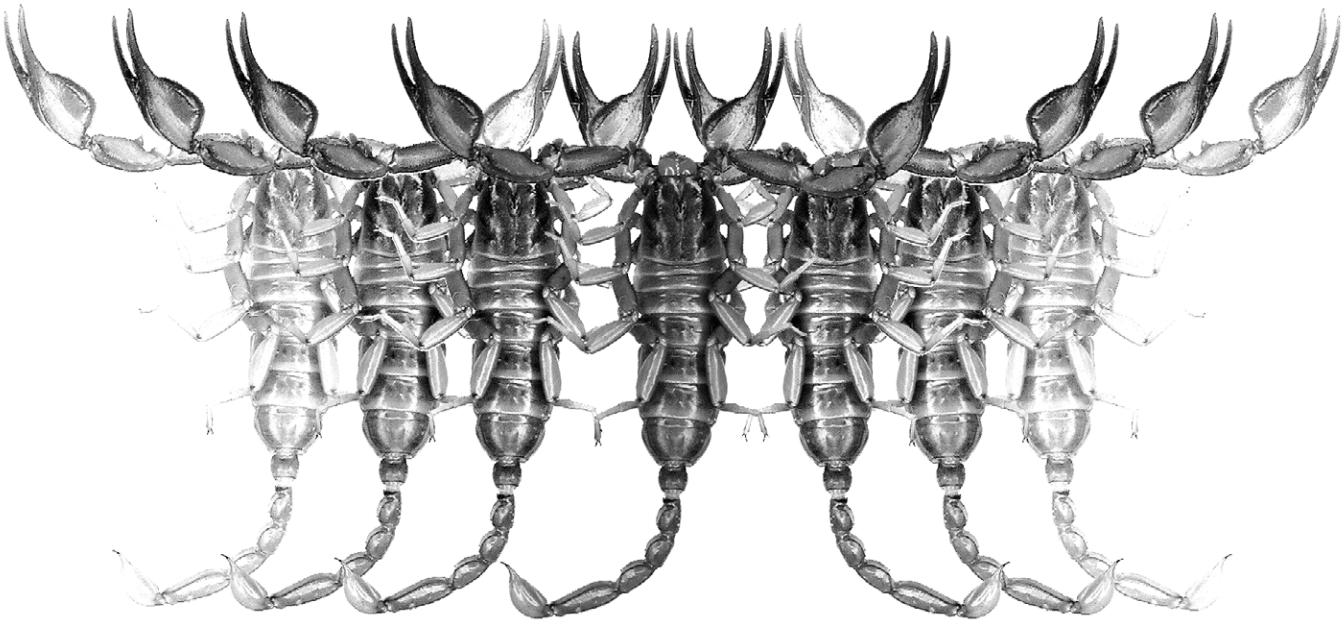

Redescription and Taxonomic Position of *Tityus atriventer* Pocock, 1897 (Scorpiones: Buthidae)

Rolando Teruel & František Kovařík

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Redescription and taxonomic position of *Tityus atriventer* Pocock, 1897 (Scorpiones: Buthidae)

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Summary

The largely neglected Lesser Antillean scorpion *Tityus atriventer* Pocock, 1897 is herein redescribed, after study of the two syntypes and one additional adult male. The latter was recently collected from Union Island (about 55 km northeast of Grenada), and it implies the first published finding of this species after its original description, and the first record of the species both outside the type-locality and from the Grenadines islands. The taxonomic position of *T. atriventer* is clarified (including designation of a lectotype and a paralectotype), its diagnosis is updated, a fully illustrated redescription is presented according to the current taxonomy of the genus, and a comparison to its morphologically closest relatives is also provided.

Introduction

The scorpion *Tityus atriventer* was described by Pocock (1897), on the basis of an adult male and female collected before 1894 in the Lesser Antillean island of Grenada. In the original description, it was correctly associated to *T. clathratus* and its then-known relatives (Pocock, 1897). Such association became unanimously accepted (Kraepelin, 1899; Mello-Leitão, 1931, 1939, 1945; Waterman, 1950; Armas, 1982, 1988; Lourenço, 1984b, 1988, 2006; Kovařík, 1998; Fet & Lowe, 2000), with the single exception of Lourenço (1984a), who considered it closer to *Tityus melanostictus* Pocock 1893.

Nevertheless, it should be noted that of the above-mentioned references, the only one which was based upon the actual study of *T. atriventer* types was that of Lourenço (1984b) and the species has not been reportedly found again. Recently, we received a tiny scorpion collected in Union Island (one of the southern Grenadines), which was immediately recognized as a member of the "*clathratus*" group, and possibly the third known specimen of *T. atriventer*. Its careful comparison to both type-specimens confirmed this identification, and revealed that the new specimen is a small but adult male.

As *T. atriventer* remains one of the most poorly known scorpions of the West Indies, we took the chance here to prepare the present paper which includes the redescription of this species according to the modern taxonomy of the genus, and its comparison to its closest relatives.

Methods & Material

The specimens were studied, measured and photographed under a Zeiss Stemi 2000-C stereomicroscope, equipped with line scale and grid ocular micrometers, and a Canon PowerShot A620 digital camera. Digital images were slightly processed with Adobe Photoshop® 8.0, only to optimize bright and contrast features. Nomenclature and measurements follow Stahnke (1970), except for trichobotriotaxy (Vachon, 1974), metasomal carinae (Francke, 1977), and sternum (Soleglad & Fet, 2003). In Table 1, all measurements are given in millimeters as length/width/depth except for the carapace, where these correspond to length/posterior width. Abbreviations for the repositories of the specimens mentioned herein are BMNH (The Natural History Museum, London, U.K.; formerly British Museum), and RTO (first author's personal collection).

Systematics

Tityus atriventer Pocock, 1897
Figs. 1–6, Tab. 1

Tityus atriventer Pocock, 1897: 519–520; Kraepelin, 1899: 75, 86; Mello-Leitão, 1931: 121, 141; Mello-Leitão, 1939: 58, 64, 72; Mello-Leitão, 1945: 299, 309; Waterman, 1950: 168; Armas, 1982: 6, tab. 2; Lourenço, 1984a: 354; Lourenço, 1984b: 101, 104; Armas, 1988: 73-74, 93.

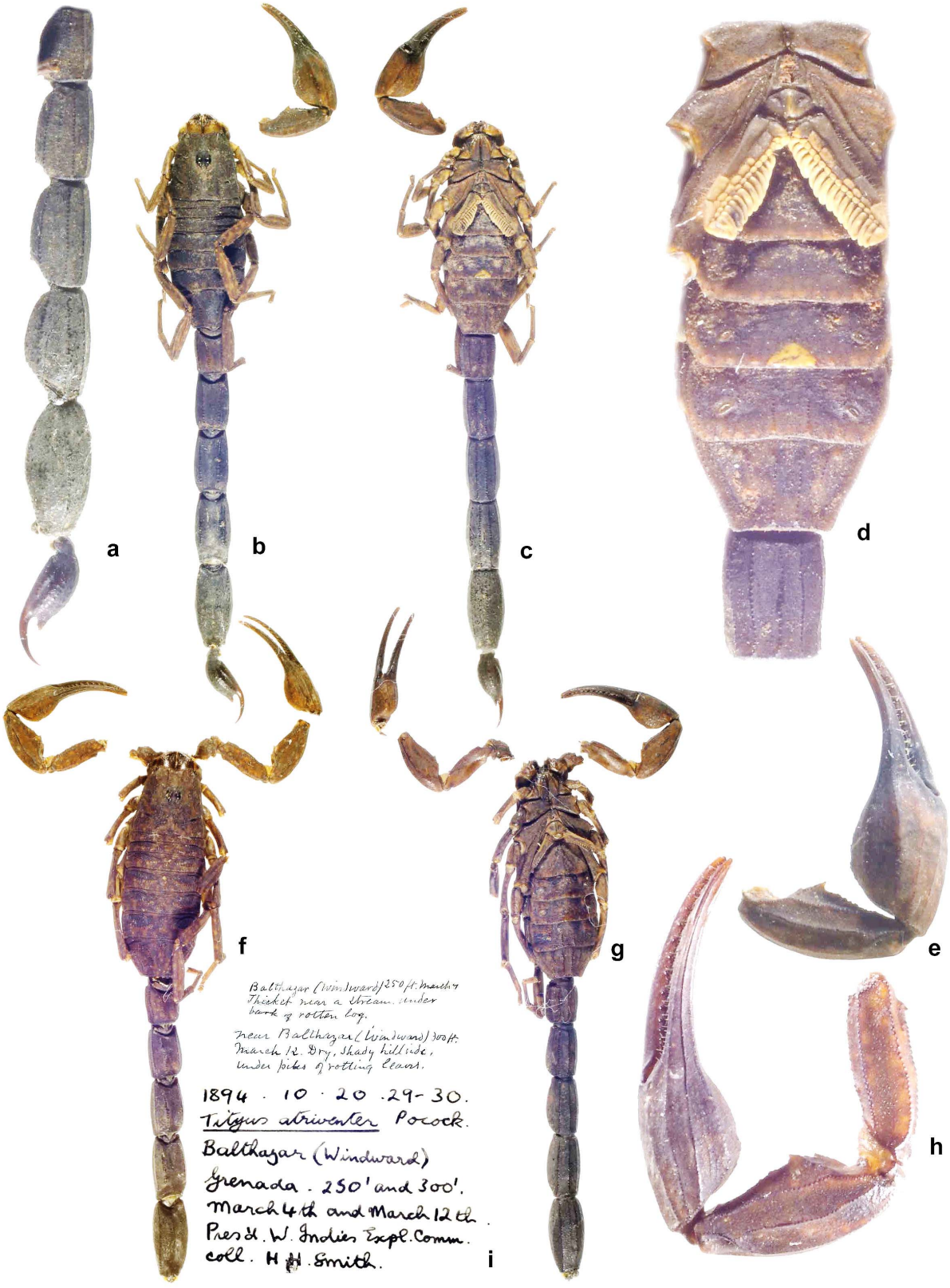

Figure 1: Male lectotype of *Tityus atriventer*: **a.** metasoma, lateral view; **b.** entire dorsal view; **c.** entire ventral view; **d.** venter; **e.** pedipalp patella and chela, dorsal view. Female paralectotype of *Tityus atriventer*: **f.** entire dorsal view; **g.** entire ventral view; **h.** pedipalp. **i.** Original labels of both types.

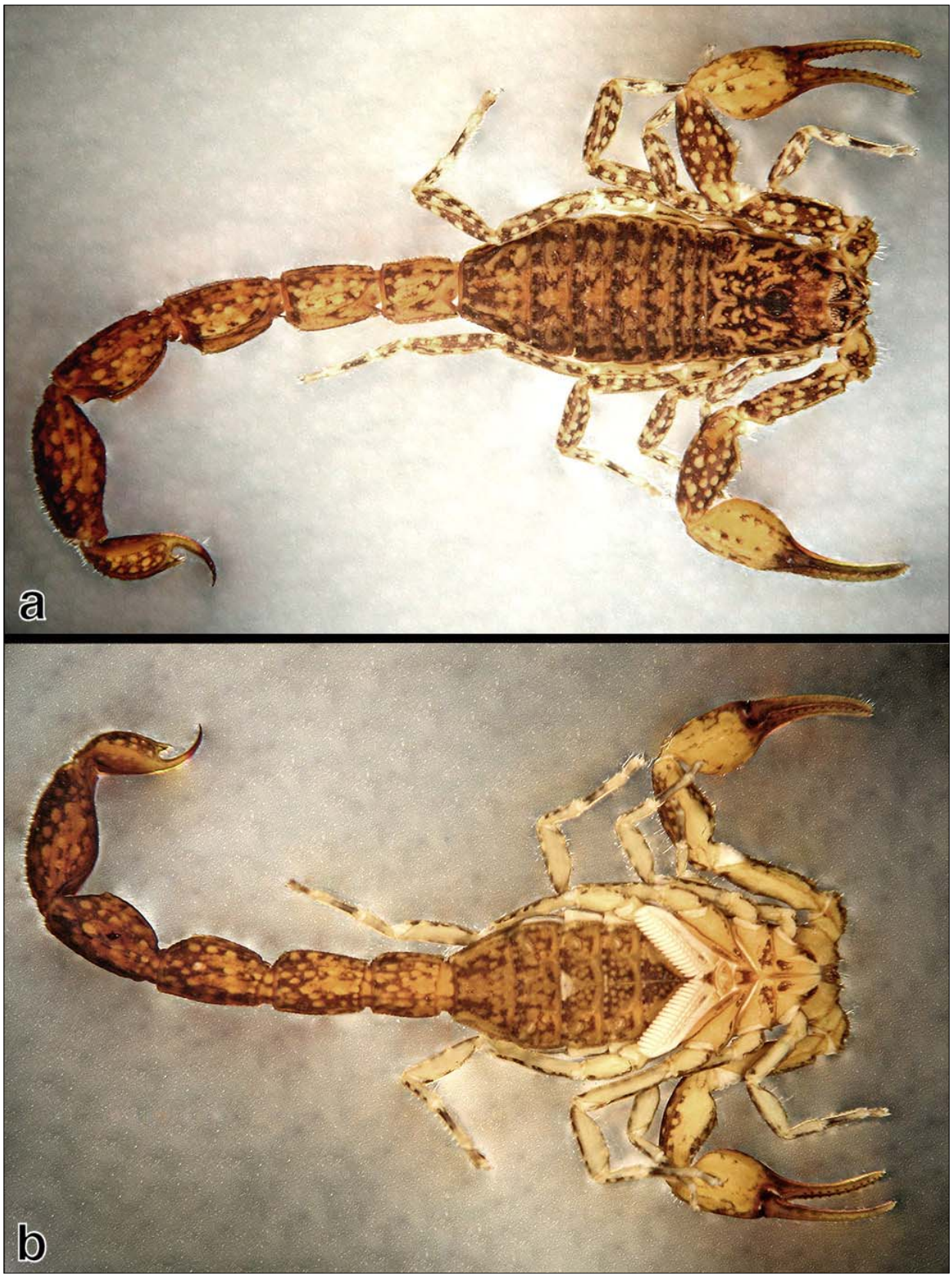

Figure 2: Adult male of *Tityus atriventer* from Union Island: **a.** entire dorsal view; **b.** entire ventral view.

Dimensions		♂ (Union Island)
Carapace	L / Wp	3.25 / 3.60
Mesosoma	L	6.20
Tergite VII	L	2.00 / 3.10
Metasoma	L	18.1
Segment I	L / W	2.00 / 1.80
Segment II	L / W	2.50 / 1.80
Segment III	L / W	2.90 / 1.80
Segment IV	L / W	3.30 / 1.80
Segment V	L / W / H	3.80 / 1.85
Telson	L	3.60
Vesicle	L / W / H	2.00 / 1.20 / 1.20
Aculeus	L	1.60
Pedipalp	L	11.95
Femur	L / W	2.90 / 1.00
Patella	L / W	3.30 / 1.40
Chela	L	5.75
Hand	L / W / H	2.35 / 1.70 / 1.70
Movable finger	L	3.4
Total	**L**	**27.55**

Table 1: Measurements of the additional adult male of *Tityus atriventer* from Union Island. Abbreviations: length (L), width (W), posterior width (Wp), depth (H).

Lourenço, 1988: 356; Kovařík, 1998: 119; Fet & Lowe, 2000: 230, 234; Lourenço, 2006: 60.

Diagnosis: species of very small size (males 28–32 mm, female 38 mm) for the genus. Body light yellowish brown, very densely spotted with blackish brown, tergites without well-defined dark stripes; metasomal segment V and telson not conspicuously darker; pedipalp fingers deeply infuscate. Pedipalp chela and metasomal segment V inflate in larger males, incrassate in smaller males and females. Sternite V with a large smooth patch in both sexes, larger and bulkier in males. Dorsolateral carinae of metasomal segments II-IV with distal tooth slightly enlarged, more so in smaller males. Telson vesicle smooth to vestigially granulose; subaculear tubercle large and conical, with two large dorsal granules. Pedipalp fixed finger with 13–14 principal rows of granules, movable finger with 14–15; basal lobe/notch combination strong in males, moderate in females. Pectines with 16–17 teeth in males, and 14–15 in females; basal middle lamella moderately dilated in both sexes.

Type data (Fig. 1i): adult ♂ lectotype (32 mm long) and adult ♀ paralectotype (38 mm long), herein designated (BMNH: 1894.10.20.29–30): GRENADA, Balthazar; 250–300 feet above sea level; March 4th and 12th; H. H. Smith. **Note:** both type-specimens were stored inside the same vial, together with three white labels which textually read (Fig. 3e): **1)** "*Balthazar (Windward) 250 ft. March 4 Thicket near stream. Under bark of rotten log.*" [handwritten by an unknown person]; **2)** "*Near Balthazar (Windward) 300 ft. March 12. Dry, shady hillside, under piles of rotting leaves.*" [handwritten by the same person as the former]; **3)** "*1894.10.20.29–30. Tityus atriventer Pocock. Balthazar (Windward) Grenada. 250′ and 300′. March 4th and March 12th. Pres 'd. W. Indies Expl. Comm. coll. H. H. Smith.*" [handwritten by Pocock in India ink]. The first two labels obviously refer to each type-specimen, but it is impossible to make a definite match; the third label suggests that Pocock received both specimens and their labels already mixed.

New Record: SAINT VINCENT AND THE GRENADINES, Parish of the Grenadines, Union Island, Chatham Bay Trail, 12°35.800 N 61°26.700 W, 31–234 m above sea level, under rocks, rotten logs and termite nests, in dry coastal forest, June 4–22, 2010, M. J. Rivera, E. Bentz, 1 adult ♂ (Sco-0471).

Figure 3: Adult male of *Trityus atriventer* from Union Island: **a.** carapace; **b.** pedipalp, dorsal view; **c.** sternopectinal region; **d.** sternite V; **e.** metasomal segments I–III, lateral view; **f.** metasomal segments IV–V and telson, lateral view.

Distribution (Fig. 5): this species has been collected only twice at Grenada and Union, two of the southernmost islands of the Lesser Antilles (Windward Islands), which are separated by a 55 km distance. It probably occurs also in other intervening Grenadines such as Carriacou and Ronde.

Redescription (based upon the adult male lectotype, unless otherwise stated): **Coloration** (Figs. 2–4: male from Union, both lectotype and paralectotype too faded for accurate description) basically light yellowish brown, very densely and irregularly spotted with blackish-brown all over the body and appendages including coxosternal region and sternites; tergites without well-defined dark stripes; metasomal segment V and telson of the same color as the remaining segments; chelicerae densely reticulated with blackish brown; pectines pale yellowish, moderately spotted with blackish brown. Pedipalps densely spotted with dark brown on both femur and patella; chela sparsely spotted over carinae, with fingers deeply infuscate. **Carapace** (Fig. 1b) trapezoidal, without distinct carinae; anterior margin very widely V-shaped; tegument very finely and densely granulose, with many coarser granules scattered; median eyes separated by about one ocular diameter; three pairs of lateral eyes. **Tergites** (Fig. 1b) with the same granular sculpture as on carapace; longitudinal carina strongly granulose; VII with two pairs of serrate lateral carinae. **Chelicerae** (Fig. 1b) with typical dentition for the genus; tegument smooth and shiny. **Pedipalps** (Figs. 1b–c, e) orthobothriotaxic A-α. Femur with all carinae coarsely granulose; intercarinal tegument very finely and densely granulose. Patella with all carinae coarsely granulose to costate; intercarinal tegument with the same granular sculpture as on femur, internal surface with conical to spiniform granules. Chela inflate, much wider than patella; hand with all carinae moderate, subgranulose to granulose, intercarinal tegument coriaceous; fingers with basal lobe/notch combination strong, fixed finger with

Figure 4: Adult male of *Tityus atriventer* from Union Island, alive in its natural habitat.

13/13 principal rows of granules, movable finger with 14/14, apical subrow composed by four granules aligned similar to principal rows. **Legs** (Figs. 1b–c) with all carinae subserrate to granulose, intercarinal tegument finely and densely granulose. **Sternum** (Figs. 1d) type 1, subpentagonal. **Pectines** (Figs. 1c–d) somewhat small, with large fulcra; pectinal tooth count 17/16; basal middle lamella moderately dilated. **Sternites** (Figs. 1c–d) very finely and densely granulose, with larger granules scattered, spiracles oval; posterior margin of sternite V with a large and smooth patch, which is light yellowish, subtriangular, wider than long and bulky; sternites VI–VII with two pairs of granulose lateral carinae. **Metasoma** (Figs. 1a–d) slightly elongate but slightly enlarged distally, especially on V which is inflate but not globular; intercarinal tegument coriaceous to smooth, without coarse granules scattered; segments I–II with ten complete carinae, III–IV with eight, V with five, all moderately developed and granulose to subcrenulate; dorsolateral carinae on II–IV with the distal tooth only slightly enlarged; telson slightly elongate, vesicle oval and smooth to vestigially granulose, with a subgranulose ventromedian carina progressively elevated towards the subaculear tubercle, which is large, conical and equipped with two large dorsal granules; aculeus long, sharp and evenly curved.

Female (paralectotype, Figs. 1f–h): in general is similar to the male, but there is a strong sexual dimorphism evidenced by: **(1)** mesosoma relatively wider; **(2)** metasoma slightly less robust; **(3)** pedipalp chela oval and more slender; **(4)** pedipalp fingers with basal lobe/notch combination less developed; **(5)** genital papillae absent; **(6)** pectines with teeth proportionally smaller; **(6)** sternite V with smooth patch slightly smaller and less bulky.

Variation: the two adult males clearly represent different size-classes. As correctly stated by Pocock (1897) in the original description of *T. atriventer*, the lectotype male and paralectotype female measure 32 mm and 38 mm, respectively, but the additional male from Union is a small adult which measures only about 28 mm (Table 1).

This specimen also exhibits less marked sexual dimorphism: compared to the lectotype, it shows pedipalp chela and metasomal segment V less incrassate, pedipalp fingers with basal lobe/notch combination less developed (but still stronger than female paralectotype), and dorsolateral carinae of metasomal segments II–IV

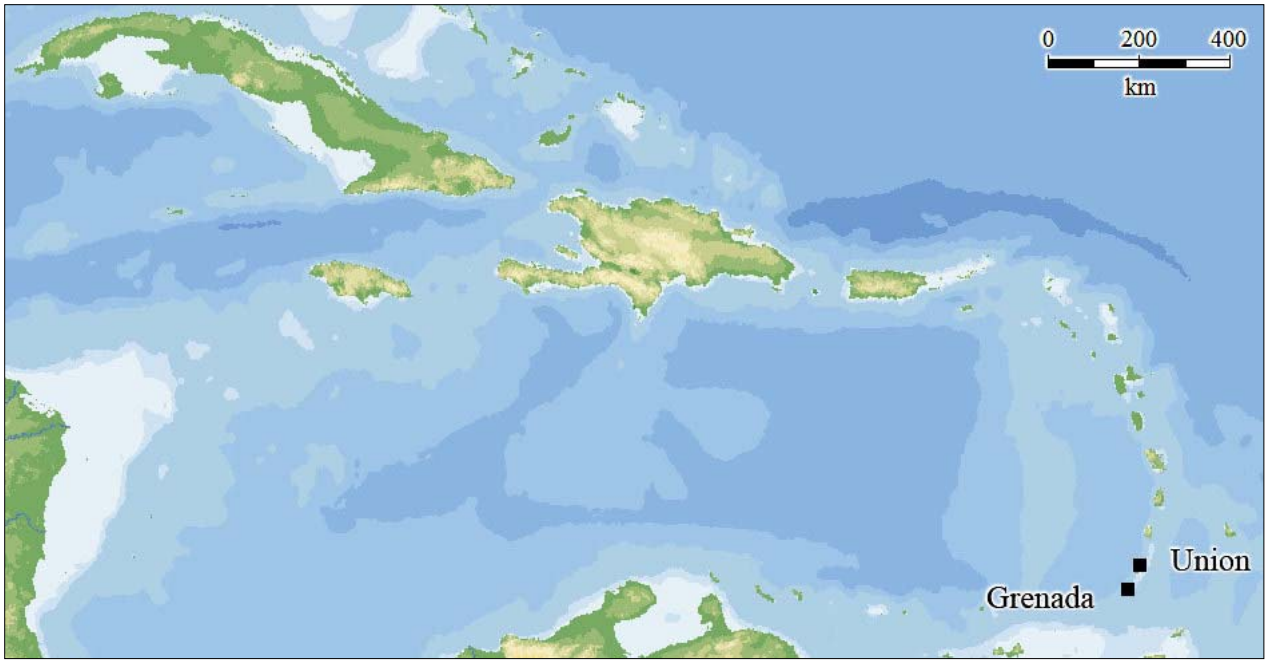

Figure 5: Known geographical distribution of *Tityus atriventer*.

with the terminal granule largest and sharpest (Figs. 1–4). This progressive size-related gradation of the expression of such dimorphic characters has been already documented in other members of the "*clathratus*" species-group (Lourenço, 1983; Montoya & Armas, 2002; Rojas-Runjaic & Armas, 2007; Teruel & García, 2008).

Pectinal tooth counts varied as follows: male lectotype 17/16, male from Union 17/17, and female paralectotype 14/15. The number of principal rows of granules varied from 13–14 on fixed finger and 14-15 on movable finger.

Ecological notes: according to their label data, one of the types was collected under bark of rotten log in thicket vegetation near a stream, and the other was found among rotting leaves on a dry, shady hillside. The Union specimen was obtained in the soil of dry coastal forest, during a search under rocks, rotten logs and termite nests (Mel J. Rivera, pers. comm.). In both islands, *T. atriventer* lives in low-altitude, dry vegetation (thicket and coastal forest below 235 m above sea level; see Fig. 6), syntopically with *Tityus pictus smithii* Pocock, 1893.

Remarks: the very peculiar shape of the subaculear tubercle (sharp and conical, with its apex straight; see Figs. 1a, 3f) makes very easy to separate *T. atriventer* from most other members of the "*clathratus*" group, which have the subaculear tubercle blunt and blade-shaped, with its apex distinctly curved towards the aculeus. The only other species of this group with a similar shape of the subaculear tubercle is *Tityus columbianus* (Thorell 1876), but this species can be distinguished by its different color pattern (tergites with three irregularly defined dark stripes, metasomal segment V and telson conspicuously darkened to blackish), lower pectinal tooth count (12–15 in males, 12–13 in females), lower count of principal rows of granules on pedipalp fingers (12–13 on fixed finger, 12–14 on movable finger), metasoma with all carinae much more strongly developed (coarsely granulose to crenulate), and metasoma and telson with intercarinal spaces densely granulose and with many coarse granules scattered; in addition, *T. columbianus* is endemic to the high plateau (2200–3100 m a.s.l.) of mid Cordillera Central, in the Colombian Andes. For a complete and widely illustrated redescription of this species see Teruel & García (2008).

The present record of *T. atriventer* represents the rediscovery of this species after its original description, as well as its first finding outside Grenada. Also, the description of this small but adult male allows knowing more about the morphometric and morphologic variation of this taxon.

Acknowledgments

This paper would have not been made without the types of *T. atriventer* loaned by Janet Beccaloni (BMNH), and the additional specimen donated by Mel J. Rivera (Carolina, Puerto Rico). Many friends and colleagues also supplied important representatives of the "*clathratus*" species-group for comparison through loans, exchanges and gifts: Luis F. de Armas (Instituto

Figure 6: General view of the habitat of *Tityus atriventer* in Union Island.

de Ecología y Sistemática, Havana, Cuba), Carlos Víquez (Instituto Nacional de Biodiversidad, Heredia, Costa Rica) and César A. Roncallo (Riohacha, La Guajira, Colombia). Luis de Armas, Michel Montoya (San José, Costa Rica) and Antonio A. Melic (Sociedad Entomológica Aragonesa, Aragon, Spain), kindly provided reprints of their published papers and additional literature. Last, but not least, Luis F. de Armas and two anonymous referees made careful peer-reviews of the manuscript.

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